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Science and Technology Perspectives

DEVELOPMENTS

Aerospace

(Japan) The Space Development Committee has revised Tokyo's space policy in an effort to make Japan "a part of the world space development nucleus" by the 21st century. The revised policy emphasizes the design of launchers capable of carrying large satellite payloads and the development of materials with space applications. Recommending cooperation with the US, Canada, and European countries, the new plan also calls for Japanese involvement in building a manned space shuttle but stresses the eventual domestic design and construction of a Japanese space station. Tokyo has allocated 6 trillion yen to the year 2000 for the overall program. (Tokyo NIHON KEIZAI SHIMBUN 4 May 87) Mitchy E. X2726

..... *Continued on Page 1*

FEATURE ARTICLES

REPORTS

PERSPECTIVES selections are based solely on foreign press, books and journals, or radio and television broadcasts. Some of the materials used in this publication will appear as abstracts or translations in FBIS serial reports. Comments and queries regarding this publication may be directed to the Managing Editor (Craig M. [redacted] or to individuals at the numbers listed with items.

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DEVELOPMENTS

DEVELOPMENTS highlight S&T events reported in the foreign media. Items followed by an asterisk will be published by FBIS. The contributor's name and telephone number are provided.

Advanced Materials Data Base

(EC) Information on European advanced materials R&D will be integrated into the two-year "Materials Databank Demonstrator Program," which will go online in October 1987 on the ECHO (European Commission Host Organization) data base host. Designed to provide comprehensive materials data services for industrial and research scientists, the Demonstrator Program will guide users to individual data bases specializing in metal alloys, ceramics, composites, electronic and organic materials, and thermodynamics. (Luxembourg ECHO NEWS No. 1, 1987) Antwerp Unit/Eva L. X2519

Aerospace

(Japan) The National Aerospace Development Agency (NASDA) has successfully conducted a fairing separation test using a H II rocket fairing manufactured by Kawasaki Heavy Industries. The test is part of NASDA's effort to domestically manufacture all H-II components, particularly the first-stage engine, the solid-fuel booster, and the fairing (for which NASDA has budgeted 2.4 billion yen in development funding). The H-II fairing is 12 meters in height, 4 meters in diameter, and weighs 1.4 tons. Up to now, US-manufactured fairings have been used in Japanese rockets (for the N-I, N-II, and H-I). (Tokyo NIKKEI SANGYO SHIMBUN 13 Apr 87) Mitchy E. X2726

CAD/CAM

(Hungary) Established in March, the R&D Association for Production Automation is developing CAD/CAM model systems for industrial use that meet international standards. The association is composed of the Ministry of Industry, Budapest Technical Univeristy, the Computer Engineering and Automation Research Institute (SZTAKI), the Central Research Institute for Physics, the Technova Industrial Bank, the Videoton Factory, the Computer Technology Applications Enterprise, and the Csepel Works Industrial Center. The Ministry of Industry will finance equipment for two CAD/CAM model systems: one to be established at Budapest Technical University (budgeted at 81.5 million forints) and the other at SZTAKI (budgeted at 60.5 million forints). (Budapest FIGYELO No. 23, 4 Jun 87) Sari P. X2907

Energy

(USSR) Soviet engineers at the V.I. Lenin All-Union Electrical Engineering Institute have developed a new type of 110 kilovolt substation that uses electron gas (not further described) instead of air as the insulating medium for current-conducting parts. The substation's high-voltage equipment is encased in a metal housing filled with electron gas under a pressure of several atmospheres. The design reportedly allows a tenfold reduction in equipment size. To date, four of these substations have been built in Moscow with 10 others slated for construction during the present Five-Year Plan. (Moscow SOTSIALISTICHESKAYA INDUSTRIYA 5 Apr 87) Vadim V. X2725

Metallurgy

(USSR) Soviet scientists are using a so-called "electron plasticity effect" (in which electric current is used to enhance a metal's malleability) to shape hard and brittle metals without galling, porosity, and dislocation. Although specific details were not given, the process reportedly will allow the industrial production of super-thin copper sheets and fine tungsten and molybdenum wire coils and spirals with record-low bending radii. (Moscow ZNANIYE-SILA No. 2, Feb 87) Alex S. X2726

New Materials

(Japan/USSR) Japan's National Research Institute for Metals and the Kyoritsu Ceramic Materials Company have jointly developed a new production method for high quality metallic materials by improving the SPS (Self-Propagating Synthesis) method originally developed by the Soviets. The new method uses high vacuum to synthesize powder materials. The process, which reduces energy consumption and cuts overall costs by half, will permit the use of titanium-aluminum alloys in auto engines and has already resulted in laboratory production of intermetallic compounds (such as nickel-titanium) and ceramic materials. Junko A. X2726

Plasma Research

(USSR) Physicists at the Kurchatov Institute of Atomic Energy have used the Tokamak-10 to raise the temperature of electrons in a plasma to 90,000,000°C—the critical temperature needed for the fusion of hydrogen isotopes into helium. The scientists now plan to develop a superdense plasma and confine it for at least one second in a field generated by superconducting magnets. (Moscow EKONOMICHESKAYA GAZETA, No. 16, Apr 87; Moscow IZVESTIYA 18 Apr 87) John H. X2723

Robotics

(Hungary) TUNGSRAM's Electronics Factory, which manufactured and shipped its first five robot control systems to the USSR's Volga Auto Factory in 1986 for use in the Soviet-manufactured Beta robot, is expected to produce an additional 220 control systems this year for the car manufacturer. The control system contains a CNC (controlled numerical counting) unit, a "teach-in" device, a diagnostic module, a service unit, and a data storage casette. TUNGSRAM and the Volga Auto Factory have a long-term cooperation agreement in the fields of robot controls, special-technology equipment, product development, and applications technology. (Budapest MAGYAR ELEKTRONIKA No. 4, Apr 87) Sari P. X2907

Warsaw Fair

(Poland/FRG) In an effort to promote joint ventures between Polish and FRG high-tech firms, Warsaw and Bonn plan to arrange "information seminars" as a prelude to an industrial forum the two governments will sponsor at the Warsaw Fair (12-15 Oct). The forum will highlight (and display equipment for) 142 possible joint venture projects in such fields as microelectronics, computers, communications, and machine tools. Information on this collaborative effort can be obtained from Unido Buero, Unter Sachsenhausen 10-26, 5000 Koln 1, BRD. (Duesseldorf HANDELSBLATT 19 May 87)* Elli M. X2519

FRG: COMPUTER HACKERS

Key Points: Computer systems linked to the FRG's Datex-P international data network have been compromised by hackers at universities in Berlin, Munich, and Hannover. In addition, a computer breakdown in Berlin has been attributed to another type of hacking, the "computer virus" (intentional bugging), according to May and June issues of DER SPIEGEL and FRANKFURTER RUNDSCHAU.

In late February the Free University (FU) of Berlin discovered that all 1109 passwords and userids for its Central Data Processing Installation (Zedat) had been acquired by two teenage hackers. For two weeks these passwords, some of which were highly privileged codes, allowed the hackers to access all systems linked to the Zedat, including the university's Control Data supercomputer, the Berlin Computer Network's Cray-1 supercomputer, and and Bundespost's Datex-P international data transmission network. Datex-P is connected to data bases worldwide (among them commercial data bases produced by the Pentagon) and to scientific data bases maintained by individual researchers. To date the only data known to have been compromised are FRG General Sick Fund account numbers, including personal data on individuals and families in the FRG, and personnel information on FU employees such as salary and health records. The Berlin hackers, caught after they shared passwords with 40 associates and ran up unusually high nighttime access bills, revealed that they had gathered passwords by observing logon procedures and printer password errors. Further random searching eventually turned up what they recognized as a high-level access code. Clues to the memory location of all the Zedat's passwords and userids were later compromised when the owner of the high-level code neglected to erase one of his working documents.

Cyber supercomputers in Munich and Hannover have also been accessed by hackers, although it is uncertain whether any data were compromised. The hackers' success is traceable primarily to lapses in security procedures. The Munich hacker gained access to part of a computer program when a high-level password was sent to the wrong printer. The hacker was caught when a system administrator noticed "nonsensical" use of the password. The Hannover hacker, although never caught, was detected only when unspecified computer problems arose.

Another type of hacking occurred last year at the Technical University (TU) of Berlin. A "computer virus," an intentional bug in various parts of a computer system, was blamed for an incident in which a computer suddenly went "haywire" and then went down completely. A GMD (Mathematics and Data Processing Association) computer security expert believed the virus had been placed in the machine's compiler, causing interference during the translation of the operating program into machine language. Similar viruses could be inserted into individual programs, main memory, or system libraries to destroy software and data.

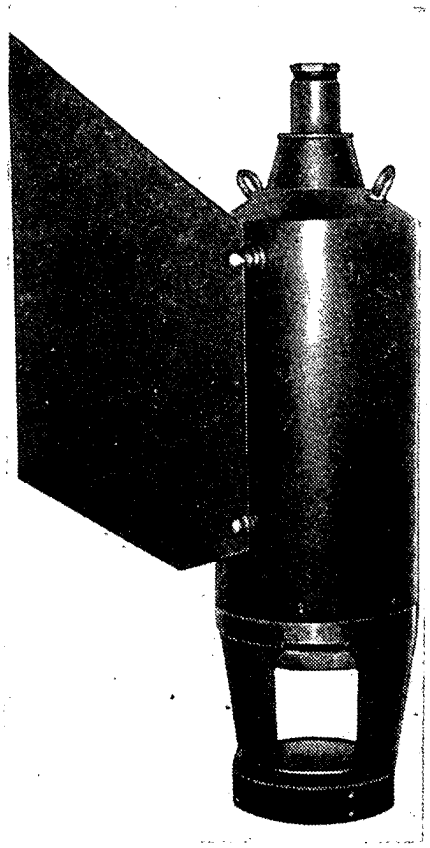
Officials at FU Berlin, the GMD, and the DFVLR (FRG Aeronautics, Space Research, and Test Center) are working to improve computer security but admit that the number of access points (notably the telephone and the Datex-P network) will complicate their efforts. In addition, experts point to an emerging hacker subculture whose clubs (such as the "Chaos Computer Club in Hamburg) and assorted publications (such as DIE DATENSCHLEUDER [The Data Agitator] and BAYERISCHE HACKERPOST [Bavarian Hacker Newsletter]) are stimulating hacking activity.

Eva L. X2519

USSR: SEA WATER DENSITY IMAGING

Key Points: Soviet scientists have developed a sensor—a remote shadow visualizer—that provides more information on ocean microstructure than previously available, according to OKEANOLOGIYA (Jan-Feb 87). Studies of the refraction index by shadow methods have applications in research on ocean stratification and mixing processes, turbulence, and underwater visibility.

The visualizer, which provides television imaging and photoelectric measurement of differences in sea water density, is based on an autocollimation shadow design with a diverging light beam within the visualization volume. The device is composed of a shadow optical visualization system and optoelectronic transducers housed in a bathysphere that is connected by cable to a data-display control console. The bathysphere is 250 millimeters in diameter with a visualization volume length of 150 millimeters. It is a highly versatile piece of equipment because of its small size, high sensitivity (twice that of systems in which the radiator and detector are separated), dual use for dynamic soundings and static operations, and capacity to record average gradient values.

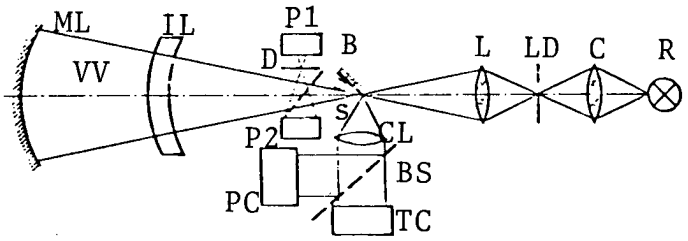


Caption: Bathysphere Housing for Visualizer

The device's optical design (see graphic below) comprises a radiation source (R), which is an incandescent lamp, equipped with a condenser (C) and a light diaphragm (LD)—all mounted on a mobile base having an electromechanical drive that allows the instrument to be remotely adjusted. The

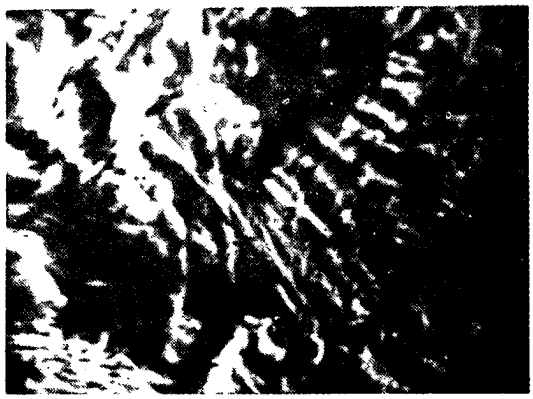
lens (L) projects an image in the light diaphragm onto the center of the reflective main lens' (ML) curvature. An illuminator (IL) in the form of a meniscus with concentric spherical surfaces is positioned between the reflective blade (B) and the reflective main lens.

Light beams passing through the visualization volume (VV) and deflected from their initial course by optical inhomogeneities, fall in the reflective blade, from which they are projected by a connecting lens (CL) through the beam splitter (BS) and onto the photoelectric (PC) and television (TC) converters. A unit to measure the directional radiation transmission factor has been installed in the shadow optical system to calculate the effect of sea water transparency on image contrast produced by inhomogeneities in the refraction field index (the ratio of the phase velocity of light in a vacuum to that in a specified medium).



The control console contains a display unit that has two channels for registering inhomogeneities in the refraction field index. A television channel displays a two-dimensional distribution of field pulsations in the plane perpendicular to the optic axis in the visualization volume. A photoelectric channel measures the intensity of pulsations averaged for the volume.

With the bathysphere positioned in a V-configuration, the visualizer has recorded numerous optical inhomogeneities during studies of temporal variability in the fine structure of sea water. The photo below is a typical image of sea water microstructure in the seasonal thermocline.



Photos such as this have provided Soviet scientists with information useful in determining the distribution and statistical characteristics of the refraction field index.

Beverly C. X2723

USSR/BULGARIA: BIOCHEMICAL COMPOUND R&D

Key Points: Soviet and Bulgarian researchers are developing a series of hormonal compounds and bacteria-derived substances for use in their countries' livestock and agrarian industries. This research is designed not only to improve cattle and crop productivity but to enhance CEMA self-sufficiency in the manufacture of these biochemical compounds, according to reports in SELSKAYA ZHIZN (25 Mar).

Soviet R&D

The Soviets reportedly have developed new methods to increase livestock productivity by programming insemination periods for cows and treating reproductive disorders with hormones. Hormones have been developed to increase impregnation in cows and reduce embryo loss, according to M. Prokofyev, director of the USSR Embryogenetic and Livestock Reproduction Section of the All-Union Science and Research Institute of Agricultural Biotechnology.

A single injection of an analog of gonadotropic-releasing hormone (called Surfagon) has increased the fertility of cows by 10 to 15 percent. Prostaglandin F2 alpha or its analogs (such as Estofan and Enzaprost); progesterone and other progestagens; gonadotropic preparations (synthetic fatty acids or hypophyseal gonadotropins); and the gonadotropin-releasing hormone or its analogs are four basic types of compounds applied to regulate reproduction in livestock.

Prostaglandin with its analog is produced in the CEMA countries and is available in the USSR's Soyuzglavzoovetsnabprom (Main Administration for Veterinary Supply and Industry of USSR Gosagroprom) and its branches. Progesterone is synthesized at the All-Union Scientific Research Pharmaceutical Chemistry Institute and used at its experimental farm. Gonadotropic hormones are also produced in the USSR. Some of the compounds, however, are still not produced in quantities sufficient for effective application.

According to Prokofyev, a new USSR all-union system for the organization of livestock reproduction is needed. He recommends the creation of a scientific center of livestock reproduction to analyze data, coordinate research, and implement methodology.

Bulgarian Efforts

Bulgaria reportedly is specializing within the CEMA framework in the production of microbiological compounds for agriculture. A biochemical facility in Peshtera is manufaturing pesticides, bacterial fertilizers, and plant growth regulators. The Peshtera facility is also producing feed additives and biologically active substances to increase livestock productivity.

An unidentified combine in Peshtera is the only facility in Bulgaria with a joint production plant/scientific research institute for the manufacture of various antibiotics and veterinary compounds derived from bacteria. These compounds improve the vitality of livestock and compensate for nutrient deficiencies in forage. The compounds Tylosin, Monensin, Bacitracin, "Koksidiostatik", "Flavofarm", and "Biovit" are being produced as feed additives to stimulate livestock growth. Their application has resulted in a 10 to 15 percent increase in meat, milk, and egg production in Bulgaria and a significant reduction in feed expenditure.

A decade ago specialists at a Sofia pharmaceutical chemistry institute (not further identified) decided to use the "Bulgarian compound" Tylosin (derived from fish meal and molasses) without refining out its protein and sugar content. Tylosin at that time was produced only under a US patent, according to the Soviet report. The Sofia institute also succeeded in developing and introducing into production at Peshtara a preparation called "Farmazin," which currently is being used by the Bulgarian livestock industry and is being exported to the Soviet Union and other countries. Subsequently, the combine in Peshtera began to produce a compound called "Farmazin-T," containing a significant amount of protein, sugar, mineral matter, and vitamins.

A recent product of the Peshtera plant is Salinomycin, an antibiotic for poultry which until recently was purchased abroad. Other high-quality products are Flavomycin and pure lysine (an essential amino acid for fattening livestock), which can be produced in the form of ampules, pellets, and powders for livestock needs. Antibiotics, growth stimulants, and lysine (previously imported from Japan) are also priority production projects of the Peshtera combine.

In addition, the Peshtara facility is producing Dipel (Bacillus thuringiensis) to protect plants against caterpillars. Plants are sprayed with a special protein crystal solution that destroys caterpillars but is nontoxic to humans, poultry, and bees. In addition, a local agro-industrial complex cooperates with the combine to supply lavender from which an antibiotic with fungicide action is produced that protects plants from powdery mildew.

Ardeth H. X2740

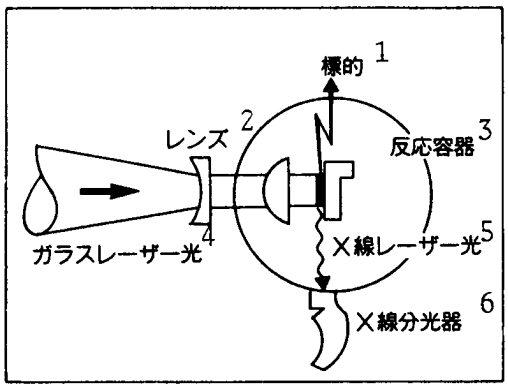
REPORTS

REPORTS surveys science and technology trends as detailed in articles, books, and journals. It also includes summaries and listings of articles and books which may serve as potential sources for future research. Conference proceedings will occasionally be presented in this section.

JAPAN: ENERGY RESEARCH & POLICY

X-RAY LASERS

A research team led by Dr. Yoshiaki Kato at Osaka University's Institute of Laser Engineering has used a recombination plasma method to generate an X-ray laser beam, according to late April reports in the Tokyo press. Such lasers have potential application in weapons systems, microelectronics manufacturing, and microbiological research. The team used the 700-billion watt Gekko M II glass laser (built for nuclear fusion research) to bombard layers of a thin organic film made of hydrocarbon, parillin $C_{40}H_{70}O_{18}$, and aluminum. As a result, carbon electrons separated from the parillin as a high-temperature plasma and aluminum electrons transferred to the plasma, immediately cooling it. The 18.2 nanometer emission lasted only several picoseconds (10^{-12}seconds). The team observed fluctuations in the laser's wavelength. The test was also conducted on layered films composed of carbon, oxygen, and aluminum, resulting in a 10.2 nanometer wavelength in the presence of oxygen and a 10.4 nanometer wavelength in the presence of aluminum.



X-Ray Laser Test Device
1) Target
2) Lens
3) Reactor
4) Glass laser
5) X-ray laser
6) X-ray photospectroscope

LIGHT WATER REACTORS

MITI's (Ministry of International Trade and Industry) newly formed Light Water Reactor (LWR) Improvement Recommendation Committee held its first meeting on 20 April under the chairmanship of Dr. Mamoru Akiyama of Tokyo University's Engineering Department, according to the Tokyo press. The committee resolved to create four working groups that will address the status of current LWRs,

next-generation LWRs, fuel technologies, and earthquake-proofing in plant construction. Specific areas of concern include high-conversion LWRs, the development of mid- and small-size LWRs, man-machine systems development, the reduction of plant radioactivity levels, radioactive waste management, the development of inspection-free construction materials, and advanced safety design concepts.

Mitchy E. X2726

USSR: NEW PUBLICATIONS

CHERNOBYL POLLUTION

The February issue of METEOROLOGIYA I GIDROLOGIYA contains the article "Radioactive Pollution of the Environment in the Accident Zone Around the Chernobyl Nuclear Power Station" by Yu. A. Izrael, chairman of the State Committee for Hydrometeorology and Environmental Control. The article describes the composition of clouds and jets of radioactive products that formed immediately after the accident; the speed, distance, altitude, and direction of propagation of the polluted air masses; the airborne and surface means of measuring the propagation and the meteorological conditions affecting propagation; the radioactive pollution of Soviet soil, rivers, and reservoirs; and the radionuclide composition of atmospheric water and soil pollution. (For a discussion of pre-Chernobyl soil and crop radiation levels, see PERSPECTIVES Vol. 2, No. 7 pp 7-8.)

MARITIME ICE CONDITIONS

The February issue of METEOROLOGIYA I GIDROLOGIYA also includes the paper "Rapid Analysis of Space Radar Images of Sea Ice," which gives a detailed discussion of new capabilities and procedures for digitally processing ice cover information gathered by satellite. The paper argues that the new methods greatly improve the reliability of visual discrimination of ice cover characteristics and add clarity in documenting results obtained from surveys. Citing the 1985 extraction of the ice-bound scientific research vessel "Mikhail Somov," the paper suggests that satellite-derived data on ice conditions make virtually any Antarctic sea rescue operation viable. In the case of the "Somov," the paper notes that scientists in Moscow using the side-looking radar aboard the Cosmos-1500 satellite were able to continuously monitor Antarctic ice dynamics, record channel openings, and communicate this data to the "Somov" and the rescuing icebreaker. This was the first Antarctic maritime rescue operation to be conducted during the polar night in a variety of weather conditions.

BALTIC UPWELLING ZONES

The journal OKEANOLOGIYA (Mar-Apr) contains the article "Detection and Systemization of Upwelling Zones in the Baltic Sea Based on Satellite Data." The Meteor-Priroda satellite reportedly has provided data in the visible and infrared range showing 14 areas in the Baltic Sea where upwellings of different intensities and lengths (0.5-10 days) occurred during summer stratification. According to the data, the surface temperature gradient was 0.5-1K/km and the cumulative temperature difference between upwelling water masses and those in the open sea was 2-10K.

MARINE METEOROLOGY

The 1986 book NONCONTACT METHODS AND EQUIPMENT FOR MEASURING OCEANOGRAPHIC PARAMETERS (Nekontaktnyye metody i sredstva izmereniy okeanograficheskikh parametrov) presents problems relating to the design and performance of new ocean research equipment. The book examines factors involved in establishing a marine meteorological test area for field calibration and trials of remote and on-site measuring devices. It also discusses a meteorological measurement and computer processing complex (which supports research by providing optical observation data), a research complex equipped with a side-looking radar and a microwave

radiometer, and a microwave radiometric complex that determines water mineralization (salinity) and temperature variations. In addition, an oil film thickness gauge and a sea ice thickness gauge are described.

A translation of the above citations will appear in USSR REPORT: METEOROLOGY AND HYDROLOGY or in USSR REPORT: EARTH SCIENCES.

Beverly C. X2723.

PREVIEWS

PREVIEWS is an annotated list of selected science and technology items being published by FBIS. The list may also contain previously published items of wide consumer interest.

SCIENCE & TECHNOLOGY/USSR: CHEMISTRY

THE CHEMISTRY OF ROCKET PROPELLANTS, JET FUELS

Book reviews the basic principles of liquid rocket and jet engine design and performance. It describes the classification, assortment, and components of rocket propellants and jet fuels. The physico-chemical and performance characteristics of the fuels, means of producing them, and the conditions for proper transport, storage, and use are outlined. Methods for testing jet fuels and a short discussion of foreign fuels are also presented. (Moscow KHIMMOTOLOGIYA RAKETNYKH I REAKTIVNYKH TOPLIV 1987)

SCIENCE & TECHNOLOGY/EUROPE & LATIN AMERICA

FRG DORNIER CHIEF ON PARTNER SEARCH, INVESTING, DAIMLER BENZ

Article examines Dornier group consolidation phase, growth rate, and Dornier Chief Schaeffler's search for a partner to help develop the Do 328 transport aircraft. Considerable growth in defense- and medical-related projects is noted. (Duesseldorf HANDELSBLATT 1 May 87)

DENMARK: INDUSTRY CRITICAL OF BIOTECHNOLOGY POLICY

Article focuses on Denmark (the first country in the world to pass a law regulating genetic engineering), which is promoting basic research but blocking application of research results or commercialization of biotechnology products. (Duesseldorf HANDELSBLATT 14 May 87)

FRG SCIENTISTS CONSIDER GENETIC ENGINEERING RISKS EXAGGERATED

Article explains that recommendations made by the FRG parliamentary commission on "Chances and Risks of Genetic Engineering" are viewed by the DFG (German Research Association) as exaggerated. (Duesseldorf HANDELSBLATT 14 May 87)

INDUSTRY GROUP URGES EUROPE-JAPAN TECHNOLOGY COLLABORATION

Article discusses study commissioned by a group of influential industrialists and politicians from Europe and Japan to evaluate a number of possible high technology projects between Europe and Japan. Deputy chairman of this group, Jacques Lesourne, is interviewed. (Stockholm NY TEKNIK 17 Apr 87)

MUNICH UNIVERSITY DEVELOPS ACID MEASUREMENT BIOSENSOR MODEL

Researchers at the Technical University of Munich have developed a theoretical model for a biosensor which measures quantities of acid generated by chemical reactions. Article summarizes the technology and applications of the device, as well as Siemens assistance in refining this pH sensor. (Wuerzburg HIGHTECH No. 2, May/June 87)

FRG THIN FILM RESEARCH, INDUSTRY PROFILED

Article outlines the status and prospects of thin film technology in the FRG with emphasis on applications in microelectronics, optics, medicine, and environmental protection. The activities of

Leybold-Hereaus, Balzers, Hochvakuum, and VDI Technologie Zentrum in this field are highlighted. (Wuerzburg HIGHTECH No. 2, May/June 87)

FRG UNIVERSITY ACHIEVES 135K SUPERCONDUCTOR

Dr. Yunas Khan of the University of Bochum has developed a composite material which has achieved superconductivity at 135K. The exact composition of the material, a variant of the known barium-lanthanum-copper oxide composite, was not released, but Dr. Khan claims that it allows a 300 microampere increase in strength over currently available materials. (Duesseldorf VDI NACHRICHTEN 15 May 87)

BOSCH GROUP ACTIVITIES, PRODUCTS REVIEWED

This interview with Bosch executives reveals their plans for the group's future activities in industrial automation. The technology and applications of Bosch robots are highlighted. (Milan AUTOMAZIONE OGGI May 87)